



PATENT
Docket No. 1018/9N

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Gaffney et al.

Serial No.: 10/087,702

Group Art Unit: 2854

Filing Date: February 28, 2002

Examiner: Funk, S.

For: OFFSET LITHOGRAPHIC
PRINTING PRESS

Address to:
Assistant Commissioner for Patents
Washington D.C. 20231

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Date: June 3, 2002

Reg. No. 41,688

Signature: Bradley S. Corsello
Bradley S. Corsello

INFORMATION DISCLOSURE STATEMENT

SIR:

Applicants submit herewith Canadian Patent Application No. 2,026,954, which corresponds to U.S. Application Serial No. 07/417,587, filed October 5, 1989, from which the present application claims priority.

Applicants maintain that the claims of the present application are supported by Serial No. 07/417,587 and are thus entitled to the October 5, 1989 filing date. Therefore, the Canadian '954 application is not prior art to the present application.

Dated: June 3, 2002

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TRANSMITTAL

Transmitted herewith is an Information Disclosure Statement filed in the
above-identified application before mailing of the first office action on the merits, with an
attached modified Form 1449, and a copy of the reference listed therein.

No fee is believed to be required, however, the Patent Office is authorized to
charge any fee that may be required to Deposit Account No. **11-0600**. A duplicate of this
transmittal sheet is included for that purpose.

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present invention and mounted in the printing press of Fig. 1;

Fig. 4 is an enlarged schematic illustration of the manner in which an incompressible outer layer of the blanket cylinder of Fig. 3 is deflected to compress a compressible inner layer at a nip between the blanket cylinder and a plate cylinder; and

Fig. 5 is a schematic illustration of the manner in which a portion of a frame of the printing press of Fig. 1 is movable to an open condition to provide access to the blanket cylinder.

Description of Specific
Preferred Embodiments of the Invention

The present invention may be embodied in a number of different constructions and applied to a number of different offset printing presses. By way of example, the drawings illustrate the present invention as applied to an offset lithographic perfecting printing press 10.

The lithographic printing press 10 prints on opposite sides of a sheet material web 12. The lithographic printing press 10 includes identical upper and lower blanket cylinders 14 and 16. Blankets 18 and 20 are mounted on the blanket cylinders 14 and 16 and apply ink patterns to opposite sides of the web 12. Upper and lower plate cylinders 22 and 24 support printing plates which are disposed in rolling engagement with the blankets 18 and 20.

at nips 26 and 28. Ink patterns are applied to the blankets 18 and 20 by the printing plates on the plate cylinders 22 and 24 at the nips 26 and 28. These ink patterns are, in turn, applied to opposite sides of the web 12 by the blankets 18 and 20.

The printing press 10 includes upper and lower dampener assemblies 30 and 32 which apply dampening solution to the printing plates on the plate cylinders 22 and 24. In addition, upper and lower inker assemblies 34 and 36 apply ink to the printing plates on the plate cylinders 22 and 24. A drive assembly, indicated schematically at 38 in Fig. 1, is operable to rotate the blanket cylinders 14 and 16 and plate cylinders 22 and 24 at the same surface speed. The drive assembly 38 also supplies power to drive the dampener assemblies 30 and 32 and inker assemblies 34 and 36. It is contemplated that the printing press 10 could have a construction other than the illustrated construction. For example, the printing press 10 could be constructed to print on only one side of the web 12.

To prevent smearing of the ink pattern, the blanket 18 has a continuous cylindrical outer surface which is free of gaps. By forming the blanket 18 with a continuous outer surface which is free of gaps, the rolling engagement between the blanket and printing plate on the plate cylinder 22 tends to be smooth and relatively vibration free. In addition, smearing of the ink pattern is prevented by making

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the blanket 18 so that it is compressible at the nip 26. This results in the blanket 18 having the same surface speed as the printing plate on the plate cylinder 22 at locations immediately before the nip, at the nip, and immediately after the nip to prevent slippage between the outer surface of the blanket 18 and the outer surface of the printing plate on the plate cylinder 22.

A cylindrical outer surface 40 of the blanket 18 is continuous and free of gaps to promote smooth rolling engagement with the cylindrical outer surface 42 of the printing plate on the plate cylinder 18. The absence of gaps in the smooth cylindrical outer surface 40 of the blanket 18 eliminates bumps or vibrations as compared to having a gap which rolls into and out of engagement with the surface 42 of the printing plate on the plate cylinder 22. The elimination of bumps or vibrations tends to minimize smearing of the ink pattern as it is applied to the surface 40 of the blanket 18 by the printing plate on the plate cylinder 22.

By providing the blanket 18 with a cylindrical outer surface 40 which is continuous and free of gaps, the diameter of the blanket 18 and the diameter of the blanket cylinder 14 can be minimized. Thus, an ink pattern can be applied to the surface 40 of the blanket throughout the entire area of the surface 40. The ink pattern can extend across an area where a gap was previously formed in the surface of known blanket cylinders.

In addition, by providing the blanket 18 with a cylindrical outer surface 40 which is continuous and free of gaps, the amount of the web 12 which is wasted during a printing operation is reduced. In one specific embodiment of the invention, approximately 0.25 inches of the web is saved on each revolution of the blanket cylinder 14.

The blanket 18 is at least partially formed of a compressible material. When a force is applied to the compressible material of the blanket 18, the volume of the compressible material decreases. The material of the blanket 18 is compressed at the nip 26 by the rigid plate cylinder 22. Since the blanket 18 is at least partially formed of compressible material, the blanket yields radially inwardly without any radially outward deformation of the blanket at the nip 26.

Since the blanket 18 is at least partially formed of a compressible material, the surface speed of the blanket is the same at all locations immediately before the nip 26, at the nip, and immediately after the nip between the blanket cylinder 18 and plate cylinder 22. Since the speed of points on the surface 40 of the blanket is the same at opposite sides of the nip 26 and at the center of the nip, there is no slippage between the surface 40 of the blanket cylinder and the surface 42 of the printing plate on the plate cylinder 22 at the nip 26. This prevents smearing of the ink pattern as it is applied to the blanket 18 by the printing plate on the plate cylinder 22.

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LITHOGRAPHIC PRINTING PRESS

Background of the Invention

The present invention relates to an offset printing press.

During operation of a offset printing press, an ink pattern is applied to sheet material by a blanket on a blanket cylinder. The pattern is applied to the blanket by a plate cylinder. Any vibrations which may be present in either the plate or blanket cylinders during operation of the press promotes smearing of the ink pattern and is detrimental to the quality of the printing. Known blanket cylinders have an axially extending gap in which opposite ends of the blanket are secured. When the blanket cylinder gap is located at a nip between the plate and blanket cylinders, vibrations tend to be induced in the cylinders. These vibrations detrimentally affect the quality of the printing and contribute to smearing of the ink pattern.

Smearing of the ink pattern is also promoted by slippage between the surfaces at the nip where the ink



pattern is transferred to the blanket. Thus, if the speed of the blanket surface is either greater or less than the speed of the surface transferring the ink pattern to the blanket the surfaces will slip relative to each other which smears the ink pattern.

Summary of the Invention

The present invention is directed to improving the quality of printing obtained from an offset printing press by eliminating or at least minimizing smearing of an ink pattern. The offset printing press includes a blanket cylinder which carries a blanket which applies the ink pattern to the sheet material. An ink transferring surface on the plate cylinder applies the ink pattern to the blanket. The ink transferring surface on the plate cylinder and blanket are disposed in rolling engagement at a nip formed between the plate and blanket cylinders.

In accordance with the present invention, the blanket is in the form of a tube having continuous outer and inner surfaces which are free of any gaps. The blanket is removably mounted on the outer peripheral circumferential surface of the blanket cylinder. The outer surface of the blanket is disposed in rolling engagement with the ink transferring surface on the plate cylinder at a nip formed therebetween. Since the outer peripheral circumferential surface of the blanket is continuous and free of gaps,

smooth and vibration free rolling engagement is obtained between the blanket and the ink transferring surface on the plate cylinder to thereby promote the transfer of an ink pattern to the blanket without smearing of the ink pattern.

The blanket is at least partially formed of a compressible material which is compressed by the plate cylinder at the nip between the printing cylinder and blanket cylinder. By compressing the compressible material at the nip, the outer surface of the blanket has a surface speed which is substantially the same at locations immediately before the nip, at the nip, and immediately after the nip. This prevents slippage between the surfaces of the printing plate and blanket before, at, and after the nip to prevent smearing of the ink pattern.

The tubular blanket has a cylindrical outer layer of incompressible material and a cylindrical layer of compressible material on an inner layer of rigid material. The outer layer of the blanket is deflectable to compress the compressible layer of the blanket. The compressible layer of the blanket contains a plurality of voids which are relatively large before the compressible layer is compressed and which are relatively small in the portion of the compressible layer which is compressed by deflection of the outer layer of the blanket at the nip.

The rigid inner layer of material is stressed in tension by the blanket cylinder to provide a tight pressure

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relationship between the blanket and the blanket cylinder. This pressure relationship fixes the blanket on the blanket cylinder so that there is no relative movement therebetween during operation of the press. The press includes means for effecting radial expansion of the tubular blanket while on the blanket cylinder to relieve the pressure relationship between the blanket and blanket cylinder. When the pressure relationship is relieved, the blanket may be manually moved axially off of the blanket cylinder. Also, the blanket must be expanded radially (tensioned radially) outwardly in order to move the blanket axially onto the blanket cylinder. The press is also provided with structure for performing this function.

In order to provide access to one end of the blanket cylinder to enable a blanket to be moved axially onto and off of the blanket cylinder, in a preferred embodiment a portion of the frame adjacent one axial end of the blanket cylinder may be moved out of the way. The tubular blanket may be moved axially through the opening in the frame created by movement of the frame portion out of the way.

To expand the blanket so that it can be placed on the cylinder, the cylinder interior may have air pressure applied thereto. Passages to the outer peripheral surface of the blanket cylinder communicate with the interior of the blanket cylinder. Air pressure applied to the interior of the blanket cylinder is thus communicated to the

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interior of the blanket to expand same as it is inserted onto the blanket cylinder. After the blanket is located on the outer periphery of the blanket cylinder, the air pressure may be removed. The blanket then contracts around the blanket cylinder and tightly engages and grips the cylinder periphery throughout the axial extent of the blanket and throughout the circumferential extent of the inner surface of the blanket. This pressure relationship between the blanket and the blanket cylinder can be relieved by again applying air pressure to the interior of the blanket cylinder to enable the blanket to be manually moved off the cylinder.

Brief Description of the Drawings

The various features of the present invention will become more apparent to one skilled in the art upon reading the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a schematic illustration of an offset printing press;

Fig. 2 is an enlarged schematic illustration of the manner in which a blanket formed of an incompressible material is deformed at a nip between plate and blanket cylinders of the printing press of Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view of a portion of a blanket constructed in accordance with the

If the blanket 18 was formed of an incompressible material, as is a blanket 18a of Fig. 2, the incompressible material of the blanket would be deflected radially outwardly and circumferentially sidewardly at a nip 26a by pressure applied against the blanket by a printing plate on the plate cylinder 22a in the manner shown schematically in Fig. 2. The incompressible material of the blanket 18a which is displaced by deflecting the blanket at the nip 26a, forms bulges 46a and 48a on opposite sides of the nip 26a.

The bulges 46a and 48a (Fig. 2) are formed because the volume of incompressible material forming the blanket 18a remains constant even though the incompressible material is deflected at the nip 26a. Therefore, the volume of material which is displaced by the printing plate on the plate cylinder 22a is equal to the volume of material in the bulges 46a and 48a. The volume of material displaced by the printing plate on the plate cylinder 22a is the same as the volume of material contained in overlapping portions of the spatial envelopes of the cylindrical outer side surface 40a of the blanket 18a and the cylindrical outer side surface 42a of the printing plate on the plate 22a. This volume of material is contained between the arcuate plane indicated by the dashed line 50a in Fig. 2 and the arcuate outer side surface 42a of the printing plate on the plate cylinder 22a and extends throughout the axial extent of the plate and blanket cylinders.

The speed of a point on the surface of the incompressible material of the blanket 18a (Fig. 2) varies as the point moves from one side of the nip 26a to the opposite side of the nip. Thus, as the material in the bulge 46a moves into the nip 26a, the material accelerates and the surface speed of the material increases. As the incompressible material leaves the nip 26a and moves into the bulge 48a, the material decelerates and the surface speed decreases.

At a given instant, a point 52a on the surface of the bulge 46a is moving slower than a point 54a at the center of the nip 26a. Similarly, a point 56a on the surface of the bulge 48a is moving slower than the point 54a at the center of the nip 26a. The magnitude of the difference in the surface speed of the incompressible material of the blanket 18a at the bulges 46a and 48a and the center of the nip 26a is a function of the extent of deflection of the incompressible material of the blanket cylinder at the nip.

As the surface speed of the incompressible blanket cylinder material moving through the nip 26a (Fig. 2) first increases and then decreases, ink pattern smearing slippage occurs between the outer side surface 40a of the blanket 18a and the outer side surface 42a of the printing plate on the plate 22a. Thus, at locations remote from the nip 26a, the surface 40a of the blanket 18a and the surface 42a the printing plate on the plate cylinder 22a have the same

speed. However, as a point on the surface 40a moves onto the bulge 46a during rotation of the blanket 18a in a counterclockwise direction (as viewed in Fig. 2), the speed of the point on the surface of the blanket decreases to a surface speed which is less than the surface speed of the printing plate on the plate cylinder 22a.

As a point on the surface 40a of the blanket 18a moves from the bulge 46a (Fig. 2) toward the center of the nip 26a, the speed of the point increases to a speed which is greater than the surface speed of the printing plate on the plate cylinder 22a. As the blanket 18a continues to rotate, the speed of movement of the point decreases as it moves from the center of the nip 26a to a point on the bulge 48a. The speed of a point on the surface of the bulge 48a is less than the surface speed of the printing plate on the plate cylinder 22a.

It should be understood that the blanket 18 of Fig. 1 does not have the same construction as the blanket 18a of Fig. 2. Thus, the blanket 18a of Fig. 2 is formed of an incompressible material. The blanket 18 of Fig. 1 is at least partially formed of a compressible material. Therefore, the blanket 18 of Fig. 1 will not deform in the manner illustrated schematically in Fig. 2.

The blanket 18 has a hollow tubular construction. The tubular blanket 18 is fixedly connected with the blanket cylinder 14 and rotates with the blanket cylinder under the

influence of the drive assembly 38. However, the tubular blanket 18 can be removed from the blanket cylinder 14 and replaced as will be discussed below.

Although the tubular blanket 18 could have many different constructions, in the specific embodiment of the invention illustrated herein, the blanket 18 has a laminated construction. Thus, the blanket 18 includes a cylindrical outer layer 66 (Fig. 3) upon which the smooth continuous outer side surface 40 of the blanket is disposed. The cylindrical outer layer 66 is formed of a resiliently deflectable and incompressible polymeric material, such as natural or artificial rubber.

A second or intermediate cylindrical layer 68 (Fig. 3) is disposed radially inwardly of the outer layer 66. The intermediate layer 68 has a cylindrical outer side surface 70 which is fixedly secured to a cylindrical inner side surface 72 of the outer layer 66. In accordance with one of the features of the invention, the cylindrical intermediate layer 68 is formed of a resiliently compressible polymeric material, such as a natural or artificial rubber.

A cylindrical third layer 74 is disposed radially inwardly of the second layer 68. The third layer 74 has a cylindrical outer side surface 76 which engages and is fixedly connected to a cylindrical inner side surface 78 of the second layer 68. Although the third layer 74 may be formed of a different material, in the illustrated

embodiment of the invention, the third layer 74 is formed of the same incompressible material as the outer layer 66.

The third layer 74 is fixedly secured to a hollow rigid metal inner layer comprising a mounting sleeve 80 which is fixedly connected to the blanket cylinder 14. A cylindrical inner side surface 82 of the third layer 74 is fixedly secured to a cylindrical outer side surface 84 of the sleeve 80. A cylindrical inner side surface 86 of the sleeve 80 engages a cylindrical outer side surface 88 of the cylinder 14. The sleeve 80, in the illustrated embodiment of the invention, is formed of nickel and is releasably fixedly connected with the blanket cylinder 14 to enable the entire blanket 18 to be slid axially onto and/or off of the rigid metal blanket cylinder 14 (Fig. 1). This construction enables the blanket 18 to be replaced after a period of use.

The sleeve 80 is stressed in tension by the blanket cylinder 14 to provide a tight pressure relationship between the blanket 18 and the blanket cylinder 14. This pressure relationship fixes the blanket 18 on the blanket cylinder 14 so that there is no relative movement therebetween during operation of the press. The press includes means for effecting radial expansion of the tubular blanket while on the blanket cylinder to relieve the pressure relationship between the blanket 18 and blanket cylinder 14, as will be described hereinbelow.

When the pressure relationship is relieved, the blanket 18

may be manually moved axially off of the blanket cylinder 14. Also, the sleeve 80 must be expanded radially or tensioned radially outwardly in order to move the blanket 18 onto the blanket cylinder 14. The press is provided with a means for performing this function, as will be discussed below.

Although the tubular blanket 18 has been described herein as having first and third layers 66 and 74 formed of an incompressible material and a second layer 68 formed of a compressible material, the tubular blanket 18 could have a greater or lesser number of layers if desired. For example, another layer of compressible material could be provided. This additional layer of compressible material could be placed immediately adjacent to the layer 68 and formed with a stiffness which is either greater or less than the stiffness of the layer 68.

When the plate cylinder 22 and blanket cylinder 18 are spaced apart from each other prior to a printing operation, that is, when the press 10 is in a thrown-off condition, the tubular blanket 18 is in the unrestrained or initial condition of Fig. 3. At this time, each of the coaxial layers 66, 68 and 74 has a cylindrical configuration.

When a printing operation is to be undertaken, the blanket 18 and a printing plate on the plate cylinder 22 are moved into engagement with each other in the manner shown in Fig. 4. As the blanket 18 and printing plate on

the plate cylinder 22 engage each other, the outer layer 66 of the blanket is resiliently deflected radially inwardly at the nip 26. The distance which the outer layer 66 is deflected radially inwardly is determined by the amount by which the initial spatial envelope of the cylindrical outer side surface 40 of the blanket 18 overlaps the cylindrical spatial envelope of the outer side surface 42 of the printing plate on the plate cylinder. Thus, the outer side surface 40 of the outer layer 66 is deflected radially inwardly from the position indicated in dashed lines at 88 in Fig. 4 to the position shown in solid lines.

The cylindrical outer layer 66 is formed of an incompressible material. When the outer layer 66 is deflected radially inwardly, the volume which is enclosed by the surface 40 of the outer layer is decreased by the volume enclosed in the space between the dashed line 88 and the side surface 40 of the deflected outer layer 66. Since the outer layer 66 is formed of an incompressible material, the volume of the outer layer itself does not change when the outer layer is resiliently deflected by the plate cylinder 22 in the manner shown in Fig. 4.

In accordance with one of the features of the invention, the inner layer 68 of the blanket 18 is formed of a compressible material. When the outer layer 66 is deflected by the printing plate on the plate cylinder 22, the inner layer 68 is resiliently compressed. Thus, the

volume of space occupied by the second layer 68 decreases from an initial or uncompressed volume (Fig. 3) to a second or compressed volume (Fig. 4) which is less than the initial volume.

Since the second layer 68 is compressed by the printing plate on the plate cylinder 22, the outer layer 66 deflects without bulging radially outwardly at opposite sides of the nip 26, in a manner similar to that shown in Fig. 2 for the blanket 18a. Thus, when the outer layer 66 of the blanket 18 is deflected by the printing plate on the plate cylinder 22 (Fig. 4), bulges corresponding to the bulges 46a and 48a of Fig. 2 are not formed in the outer layer 66. This is because the inner layer 68 is compressed by an amount sufficient to accommodate the deflected material of the outer layer 66.

As a result of the compression of the inner layer 68 and the lack of bulges in the outer layer 66, the speed at locations on the surface 40 of the outer layer immediately before the nip 26, at the center of the nip, and immediately after the nip are substantially the same as the speed of the surface of the printing plate on the plate cylinder 22. Therefore, there is smooth rolling engagement between the blanket 18 and printing plate on the plate cylinder 22 at the nip 26 without slippage between the surfaces 40 and 42. Of course, this promotes the transfer of an ink pattern from the printing plate on the plate cylinder 22 to the blanket 18 without smearing the pattern.

The compressible second or inner layer 68 is formed from a resilient foam which contains voids. When the outer layer 66 is deflected and the inner layer 68 is compressed (Fig. 4), the voids are reduced in size or eliminated. As the voids in the polymeric foam forming the second layer 68 are compressed, the volume of the compressible material forming the second layer 68 is reduced.

Prior to deflection of the outer layer 66 of the blanket 18 and compression of the inner layer 68 (Fig. 3), the tubular blanket 18 and blanket cylinder 14 occupy a relatively large first volume which is enclosed by the continuous cylindrical outer surface 40 of the outer layer 66. At this time, the cylindrical intermediate layer 68 contains relatively large voids and occupies a relatively large first or initial volume. Upon engagement of the blanket 18 and printing plate on the plate cylinder 22 (Fig. 4), the outer layer 66 of the blanket 18 is deflected radially inwardly. Deflection of the tubular outer layer 66 results in the blanket 18 occupying a volume which is less than its original or undeflected volume. However, the total volume of the outer layer 66 remains constant and the outer layer does not bulge outwardly adjacent to opposite sides of the nip 26 in the manner shown in Fig. 2 for the blanket 14a.

As the outer layer 66 is deflected, the inner layer 68 of the blanket 18 is compressed to a volume which is less

than the initial volume of the layer 68. The difference between the initial volume of the second layer 68 (Fig. 3) and the compressed volume of the second layer (Fig. 4) is equal to the volume between the dashed line 88 in Fig. 4 and the outer side surface 40 of the outer layer 66. Therefore, the reduction in volume of the space occupied by the blanket 18 is accommodated by compressing the second layer 68 and the only deflection of the outer layer 66 is in a radially inward direction.

It is contemplated that the blanket 18 could have a construction which is different than the specific construction illustrated in Figs. 3 and 4. For example, a deflectable fabric or inextendable material could be provided between or in each of the layers 66, 68 and 74. The number of layers could be either increased or decreased. Although it is preferred to form the compressible second layer 68 from a polymeric foam of uniform stiffness, the second layer could be formed with cylindrical inner and outer sections of void-containing foam having different stiffnesses. The compressible inner layer 68 could also be formed of a material other than foam, for example, a resiliently deflectable mesh or fabric.

The blanket 18 is formed by spraying adhesive on the cylindrical outer side surface 84 of the metal sleeve 80. Preformed strips of material are then wrapped in layers around the sleeve. The strips include strips of the

incompressible material of the outer layer 66, the compressible material of the second layer 68 and the incompressible material of the third layer 74. The rubber material of the strips is then vulcanized to form a solid body which encloses the metal sleeve 80. Alternatively, the blanket could be made in a flat planar piece of material which is then wrapped around sleeve 80 and adhered thereto. The opposite ends of the piece of material would abut each other.

Although the construction of only the blanket 18 is shown in Figs. 3 and 4, the blanket 20 has the same construction as the blanket 18. Thus, the blanket 20 cooperates with the printing plate on plate cylinder 24 at the nip 28 in the same manner that the blanket 18 cooperates with the printing plate on the plate cylinder 22 at the nip 26.

As noted above, the tubular blanket 18 can be telescopically mounted on and removed from the blanket cylinder 14 while the blanket cylinder remains in the printing press 10. Access is provided to one axial end portion of the blanket cylinder 14 by preferably having a portion 94 of a side frame 96 of the printing press 10 movable between open and closed conditions. When side frame portion 94 is in the closed condition, it engages a bearing assembly 98 to support one end of the blanket cylinder 14.

When it is desired to remove a blanket 18 from the blanket cylinder 14 and replace it with another blanket, the portion 94 of the frame is moved from the closed condition to the open condition illustrated in Fig. 5. This provides an opening 102 in the frame 96 through which the blanket 18 can be moved. In the embodiment of the invention illustrated schematically in Fig. 5, the movable portion 94 of the frame is mounted for pivotal movement about a vertical axis by a hinge (not shown) which interconnects the movable portion 94 and the frame 96. However, the movable portion 94 could be mounted in a different manner if desired.

When the movable portion 94 is pivoted to the open condition of Fig. 5, the end of the blanket cylinder 14 opposite from the side frame 96 supports the entire weight of the blanket cylinder. To enable the blanket cylinder to be supported at only one end, a relatively strong bearing arrangement may be mounted in the opposite side frame or a counterpoise may be connected with the end of the blanket cylinder 14 opposite from the side frame 96.

When the movable portion 94 of the side frame 96 has been moved to the open condition of Fig. 5, a blanket 18 can be manually moved axially off of the blanket cylinder 14 through the opening 102. A new blanket 18 is then axially aligned with the blanket cylinder 14 and slid onto the blanket cylinder. Once the new blanket 18 has been

slid onto the blanket cylinder 14, the movable portion 94 of the side frame is moved back to its closed condition in engagement with the bearing 98 to support the blanket cylinder for rotation about its horizontal central axis.

An alternative to having a removable portion of the frame for removal of the blanket is to completely remove the blanket cylinder from the press by a crane and replace the blanket at a location away from the press.

Alternatively, the blanket cylinder could be hinged at one end in such a manner that it could be pivoted into a position at which the blanket could be removed from the blanket cylinder.

The blanket 18 and the blanket cylinder 14 have a metal-to-metal interference fit between the cylindrical metal sleeve 80 (Fig. 3) on the inside of the blanket 18 and the outer circumference of the metal blanket cylinder 14. Thus, the inner side surface 86 (Fig. 3) of the cylindrical sleeve 80 has a uniform diameter which is slightly less than the uniform diameter of the cylindrical surface 88 on the outside of the metal blanket cylinder 14. The extent of interference required between the sleeve 80 and blanket cylinder 14 must be sufficient to enable the blanket 18 to firmly grip the blanket cylinder outer circumference during operation of the press 10 so that the blanket does not slip relative to the blanket cylinder.

In order to manually slide the blanket 18 onto the

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by fluid pressure. Thus, the blanket cylinder 14 is provided with radially extending passages 106 (Fig. 3). The radially extending passages 106 are evenly spaced apart in a large number of radial planes which extend through the blanket cylinder 14 throughout the length of the blanket cylinder.

The blanket cylinder 14 is hollow and is connected with a source of fluid (air) under pressure by a conduit 110 (Fig. 5). The air pressure conducted through the conduit 110 to the interior of the blanket cylinder 14 flows outwardly through the passages 106 (Fig. 3) and presses against the inner side surface 86 of the metal sleeve 80. The air pressure causes the metal sleeve 80 to resiliently expand circumferentially an amount sufficient to enable the blanket 18 to be manually slid onto the blanket cylinder 14 with a minimum of difficulty.

Once the blanket 18 has been positioned axially on the blanket cylinder 14, the interior of the blanket cylinder 14 is vented to atmosphere. The sleeve 80 and the blanket 18 then contracts to securely grip the outer surface 88 of the blanket cylinder 14. The sleeve 80 is then maintained in tension by the blanket cylinder 14. In one specific embodiment of the blanket 18, an air pressure of approximately 60 psi is necessary to effect the expansion of the sleeve 80. Of course, the magnitude of the air pressure required to effect the necessary resilient

expansion of the sleeve 80 may vary as a function of the radial thickness of the sleeve 80, the material from which the sleeve is made and the extent of interference between the sleeve and the blanket cylinder 14.

The present invention is directed to improving the quality of printing obtained from an offset printing press by eliminating or at least minimizing smearing of an ink pattern applied to sheet material 12 by the printing press. The printing press includes a blanket cylinder 14 which carries a blanket 18 which applies the ink pattern to the sheet material. An ink transferring surface on the plate cylinder 22 applies the ink pattern to the blanket 18. The ink transferring surface and the blanket are disposed in rolling engagement at a nip 26 formed between the two cylinders.

The blanket 18 has an outer peripheral circumferential surface 40 which is free of an axially extending gap. A blanket 18, in the form of a tube having continuous outer and inner surfaces 40 and 86, is removably mounted on the outer peripheral circumferential surface 88 of the blanket cylinder 14. The outer surface 40 of the tube is disposed in rolling engagement with an ink transferring surface on the plate cylinder 22 at a nip 26. Since the outer peripheral circumferential surface 40 of the blanket 18 is continuous and free of gaps, smooth and vibration free rolling engagement is obtained between the ink transferring

surface of the plate cylinder and blanket to thereby promote the transfer of an ink pattern to the blanket without smearing of the ink pattern.

The blanket 18 is at least partially formed of a compressible material which is compressed by the printing plate at the nip 26. By compressing the compressible material at the nip 26, the outer surface 40 of the blanket 18 has a surface speed which is substantially the same at locations immediately before the nip 26, at the nip, and immediately after the nip. This prevents slippage between the ink transferring surface of the plate cylinder and the blanket before, at, and after the nip to prevent smearing of the ink pattern.

The blanket 18 is a tube with a cylindrical outer layer 66 of incompressible material and a cylindrical inner layer 68 of compressible material. The outer layer 66 of the blanket 18 is deflectable to compress the inner layer 68 of the blanket. The inner layer 68 of the blanket contains a plurality of voids which are relatively large before the inner layer of the blanket is compressed and which are relatively small in a portion of the inner layer of the blanket which is compressed by deflection of the outer layer of the blanket.

The blanket 18 is manually slid onto the blanket cylinder 14 from an axial end thereof. In order to provide access to one end of the blanket cylinder 14, preferably a

portion of the frame adjacent one axial end of the blanket cylinder may be moved out of the way. The tubular blanket 18 is inserted axially through the frame 96 onto the blanket cylinder 14 which is aligned with the blanket.

To facilitate insertion of the blanket 18 onto the cylinder 14, the cylinder interior may have an air pressure applied thereto. Passages 106 to the outer peripheral surface 88 of the blanket cylinder 14 communicate with the interior of the blanket cylinder. Air pressure applied to the interior of the blanket cylinder 14 is thus communicated to the interior of the blanket 18 to expand same as it is inserted onto the blanket cylinder. After the blanket 18 is located on the outer periphery of the blanket cylinder 14, the air pressure may be removed. The blanket 18 then contracts around the blanket cylinder 14 and tightly engages and grips the blanket cylinder periphery throughout the axial extent of the blanket and throughout the circumferential extent of the inner surface 86 of the blanket 18.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An offset printing press comprising
a frame,
a plate cylinder rotatably supported by the frame
and supporting a printing plate for carrying an image to be
printed,
an inker for applying ink to the printing plate,
a blanket cylinder rotatably supported by said
frame,
an axially removable tubular printing blanket
mounted to the blanket cylinder for receiving the ink
pattern to be printed from the printing plate and
transferring said pattern to a material to be printed,
the printing plate and the tubular blanket being
disposed in rolling engagement at said nip formed
therebetween,
the tubular blanket comprising an outer layer of
material, an inner layer of material and an intermediate
layer of material, the outer layer being a continuous
tubular layer of incompressible material indented by the
printing plate at the nip, the inner layer being a
continuous tubular layer of rigid material and the
intermediate layer being a layer of compressible material;

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a drive operable to rotate the plate cylinder and the blanket cylinder such that the blanket has the same surface speed as the printing plate.

2. An offset printing press as set forth in claim 1 and means to fix said tubular blanket on said blanket cylinder during operation of the press.

3. An offset printing press as set forth in claim 1, said rigid inner layer of material being stressed in tension by said blanket cylinder to provide a pressure relationship between said inner surface and said blanket cylinder to fix said blanket on said blanket cylinder during operation of the press.

4. A printing press as set forth in claim 1 further including means for effecting radial expansion of said tubular blanket while on said blanket cylinder to relieve said pressure relationship between said inner circumferential surface of said tubular blanket and said blanket cylinder to enable said tubular blanket to be manually moved axially off of said blanket cylinder.

5. A printing press as set forth in claim 4 wherein said tubular blanket includes a cylindrical outer layer of incompressible material on said layer of compressible material, said outer layer of said tubular blanket being deflected by said plate cylinder at said nip to compress

said inner layer, said outer surface of said tubular blanket having a surface speed which is the same at locations immediately before said nip, at said nip and immediately after said nip to prevent smearing of the ink pattern at said nip.

6. A printing press as set forth in claim 5 wherein said outer layer of said tubular blanket encloses a first volume when said outer layer of said tubular blanket is in an undeflected condition prior to deflection of said outer layer of said tubular blanket by said plate cylinder, said outer layer of said tubular blanket enclosing a second volume which is the same as said first volume when said outer layer of said tubular blanket is deflected by said plate cylinder, said compressible material of said inner layer of said tubular blanket occupying a third volume when said outer layer of said tubular blanket is in the undeflected condition, said inner layer of said tubular blanket occupying a fourth volume which is less than said third volume when said outer layer of said tubular blanket is deflected by said plate cylinder.

7. A printing press as set forth in claim 6 wherein the compressible material of said inner layer contains voids which are of a first size when said outer layer of said tubular blanket is in the undeflected condition and at least some of which are of a second size which is less than the first size when said outer layer of said tubular

blanket is deflected by the printing plate on said plate cylinder.

8. A printing press as set forth in claim 1 wherein said frame for supporting said plate and blanket cylinders has a portion movable between a supporting condition in axial alignment with said blanket cylinder and an open condition spaced from said blanket cylinder to provide an opening in said frame, said tubular blanket being movable through the opening in said frame into engagement with said blanket cylinder when said portion of said frame is in the open condition.

9. A printing press as set forth in claim 1 wherein said blanket cylinder has a cylindrical rigid outer surface with a first diameter, said tubular blanket having a cylindrical rigid inner surface with a second diameter which is less than the first diameter to provide for interference between said blanket cylinder and said tubular blanket, said blanket cylinder including passage means for directing a flow of fluid against the inner surface of said tubular blanket means to expand said tubular blanket and increase the second diameter to enable said tubular blanket to be moved axially onto said blanket cylinder.

10. A printing press as set forth in claim 1 wherein said tubular blanket includes a cylindrical outer layer of incompressible material, a cylindrical intermediate layer

of compressible material and a hollow rigid inner sleeve connected with and disposed radially inwardly of said outer and intermediate layers, said rigid inner sleeve having an interference fit with said blanket cylinder.

11. A printing apparatus comprising a rotatable blanket cylinder; a tubular blanket mounted on said blanket cylinder for applying an ink pattern to material; a rotatable plate cylinder having an ink transferring surface for applying the ink pattern to said tubular blanket; the ink transferring surface and said tubular blanket being disposed in rolling engagement at a nip formed therebetween; said tubular blanket including a cylindrical outer layer of incompressible material, a cylindrical intermediate layer of compressible material, and an inner layer of rigid material; said outer layer of said tubular blanket having a continuous outer surface which is free of gaps and which is disposed in rolling engagement with the ink transferring surface on said plate cylinder at said nip; said outer layer of said tubular blanket being deflectable to compress at least a portion of said inner layer of said tubular blanket from a first condition to a second condition.

12. A printing apparatus as claimed in claim 11 wherein said inner layer of said tubular blanket contains a plurality of voids which are relatively large when said inner layer of said tubular blanket is in the first

condition and which are relatively small in a portion of said inner layer of said tubular blanket which has been compressed to the second condition by deflection of said outer layer of said tubular blanket.

13. A printing apparatus as claimed in claim 11 wherein said outer layer of said tubular blanket encloses a first volume when said outer layer of said tubular blanket is in an undeflected condition prior to deflection of said outer layer of said tubular blanket at said nip, said outer layer of said tubular blanket enclosing a second volume which is the same as said first volume when said outer layer of said tubular blanket is deflected at said nip, said compressible material of said intermediate layer of said tubular blanket occupying a third volume when said outer layer of said tubular blanket is in the undeflected condition, said intermediate layer of said tubular blanket occupying a fourth volume which is less than said third volume when said outer layer of said tubular blanket is deflected at said nip.

14. A printing apparatus as set forth in claim 11 wherein said outer layer is formed of a solid and resiliently deflectable polymeric material which is incompressible and said inner layer is formed of a resiliently deflectable foam of polymeric material which is compressible and contains voids.

15. A printing apparatus as set forth in claim 11 further including a frame for supporting said plate and blanket cylinders, said frame having a portion movable between a supporting condition in axial alignment with said blanket cylinder and an open condition spaced from said blanket cylinder to provide an opening said frame, said tubular blanket being movable through the opening in said frame into engagement with said blanket cylinder when said portion of said frame is in the open condition, said blanket cylinder having a cylindrical rigid outer side wall with a first diameter, said tubular blanket having a cylindrical rigid inner side wall with a second diameter which is less than the first diameter to provide for interference between said blanket cylinder and said tubular blanket, said blanket cylinder including passage means for directing a flow of fluid against the metal inner side wall of said tubular blanket to expand said tubular blanket and increase the second diameter to enable said tubular blanket to be moved axially onto and off of said blanket cylinder when said portion of said frame is in the open condition.

16. Apparatus comprising a tubular blanket for mounting on a blanket cylinder and for receiving an ink pattern at a nip formed by an ink transferring surface and said tubular blanket and for applying the ink pattern to material; said tubular blanket including an outer layer of incompressible material, an intermediate layer of compressible material, and an inner layer of rigid material; said outer layer of

said tubular blanket having a continuous outer surface which is free of gaps and which is positionable in rolling engagement with the ink transferring surface at the nip; said outer layer of said tubular blanket being deflectable to compress at least a portion of said inner layer of said tubular blanket from a first condition to a second condition at the nip; said inner layer of said tubular blanket containing a plurality of voids which are relatively large when said inner layer of said tubular blanket is in the first condition and which are relatively small in a portion of said inner layer of said tubular blanket which is compressed to the second condition by deflection of said outer layer of said tubular blanket.

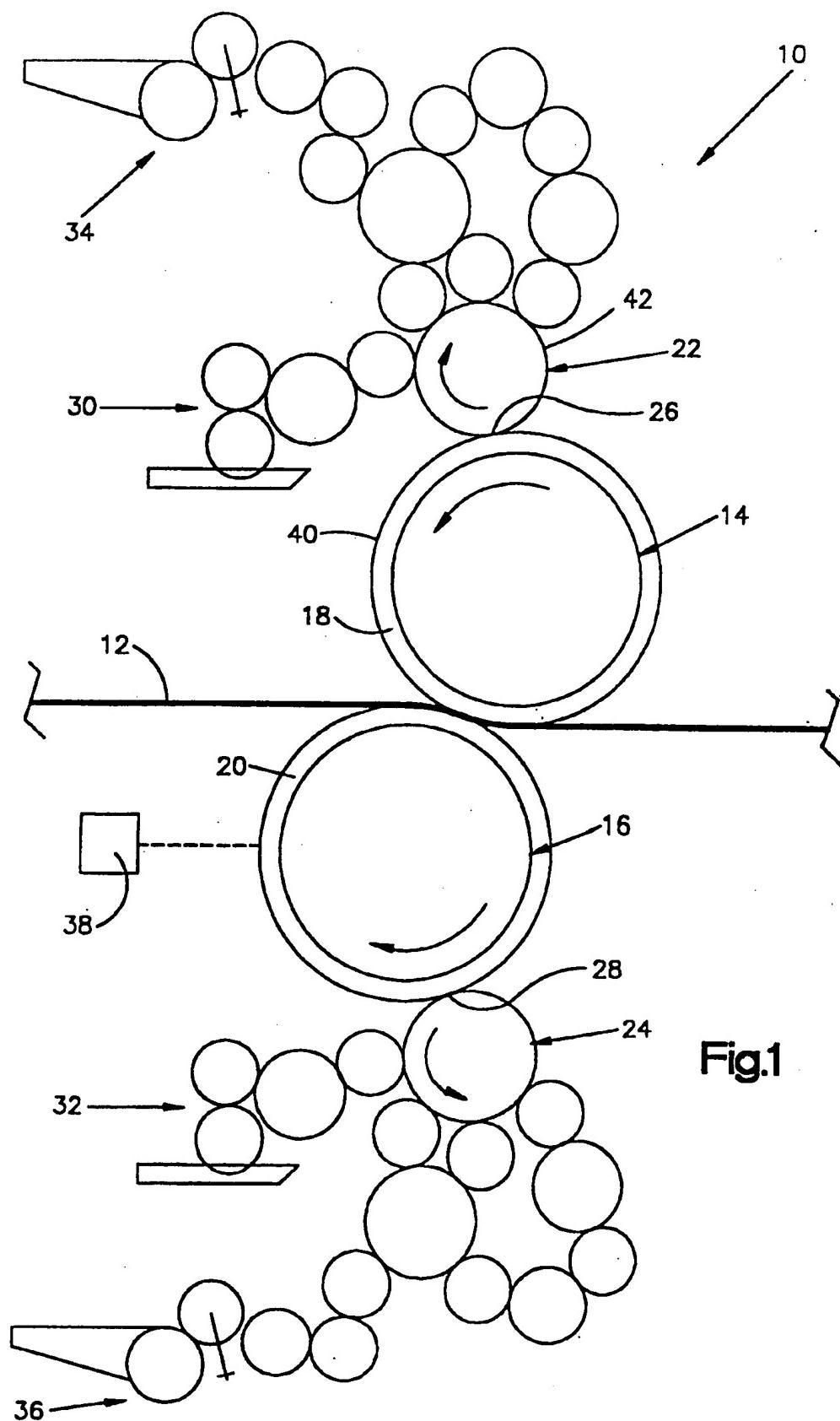
17. A printing press as set forth in claim 16 wherein the blanket cylinder has a cylindrical rigid outer surface with a first diameter, and said inner layer of rigid material is for contacting the rigid outer surface of the blanket cylinder.

18. A printing press as set forth in claim 17 wherein said rigid inner layer of said tubular blanket comprises a hollow sleeve having a diameter less than the diameter of the blanket cylinder to provide an interference fit with the blanket cylinder.



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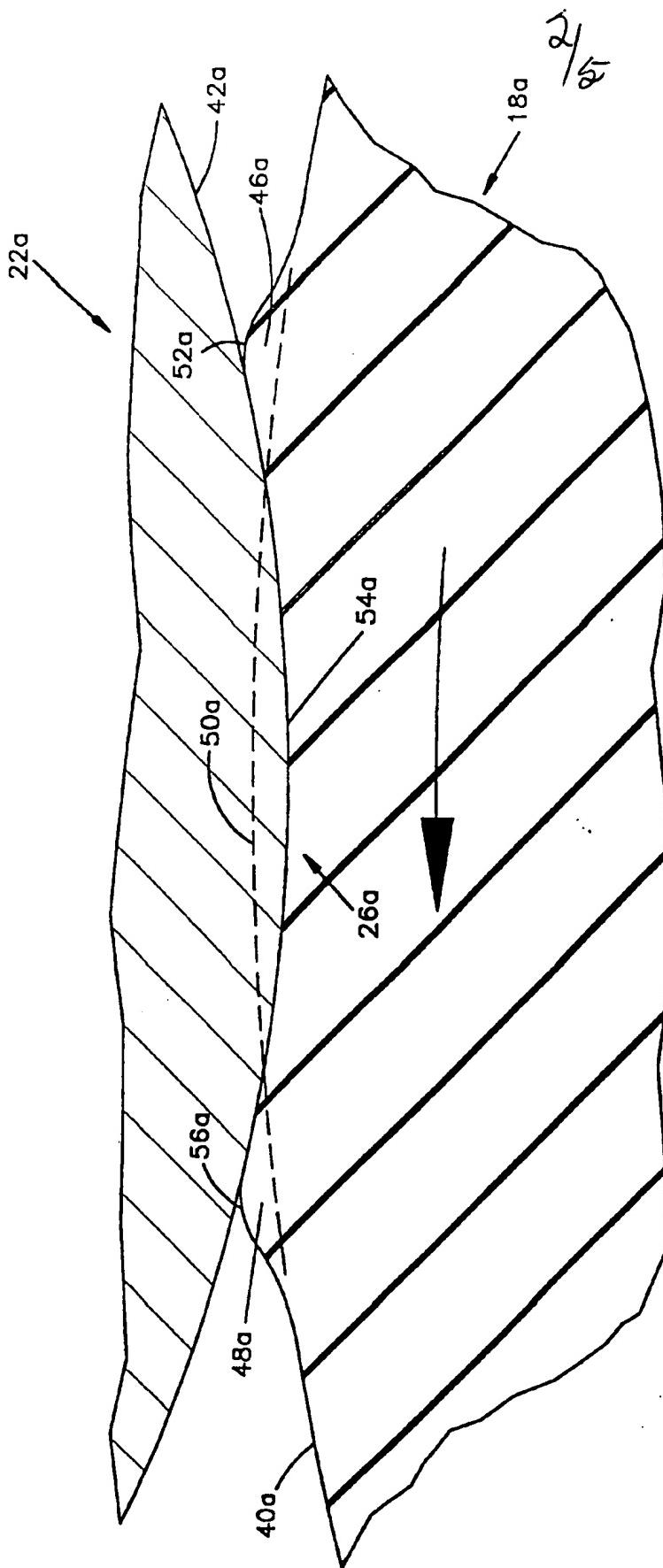
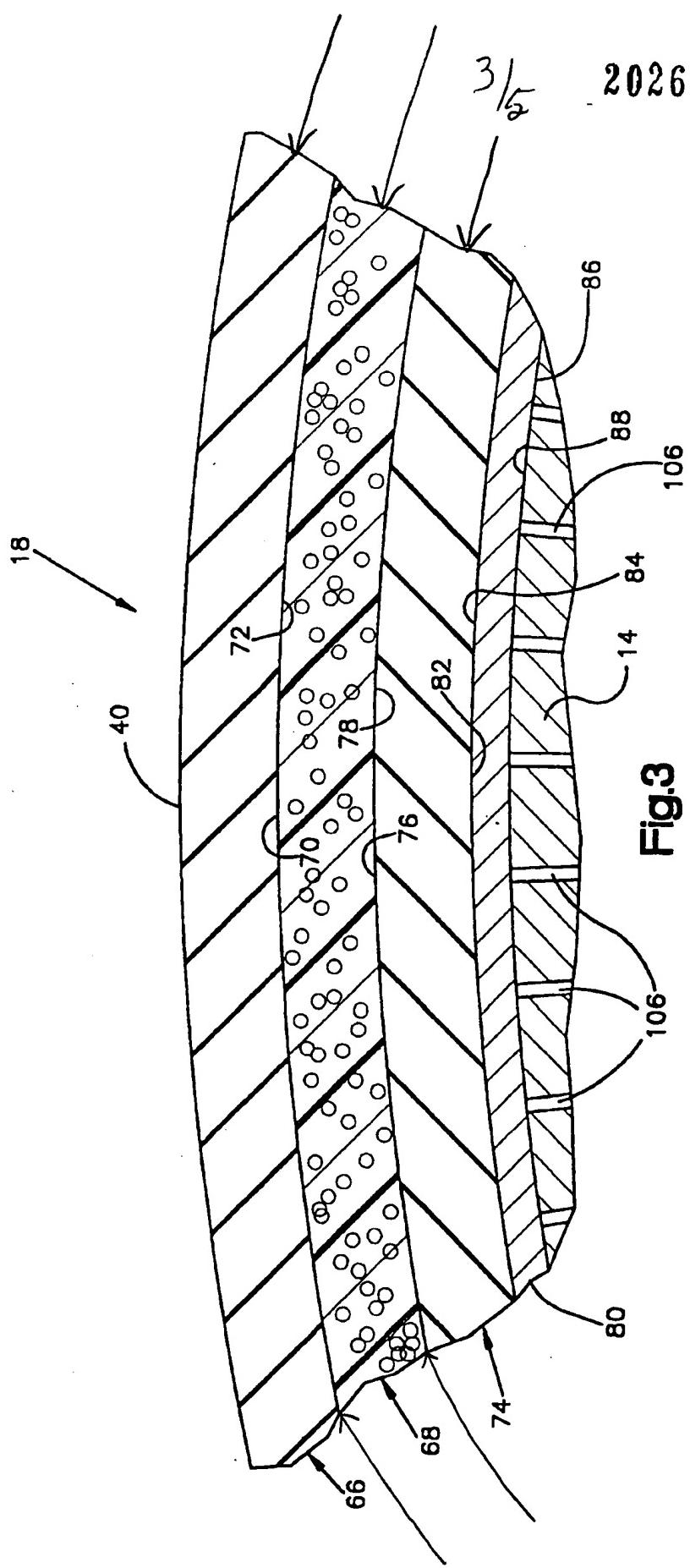


Fig.2

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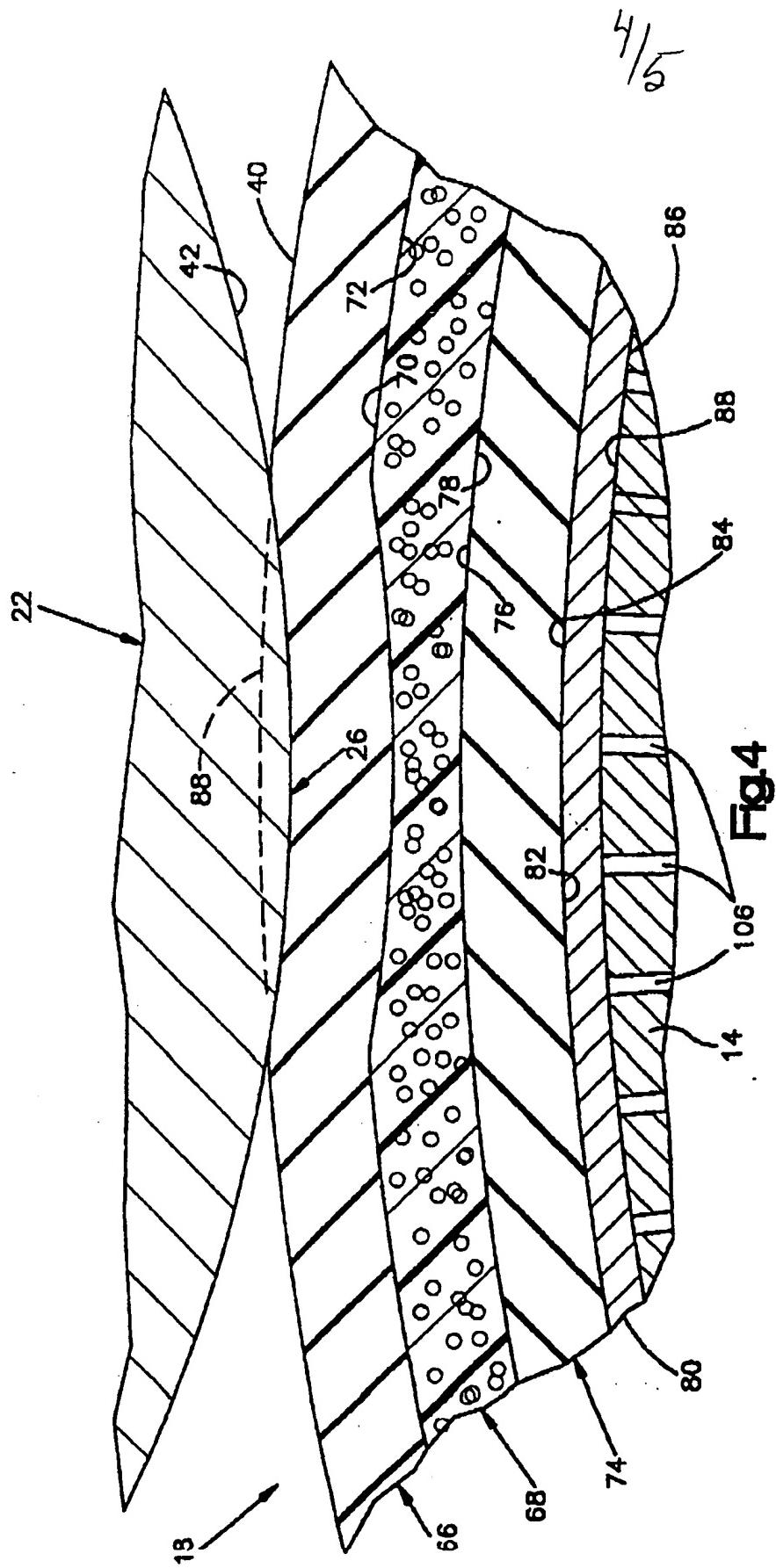
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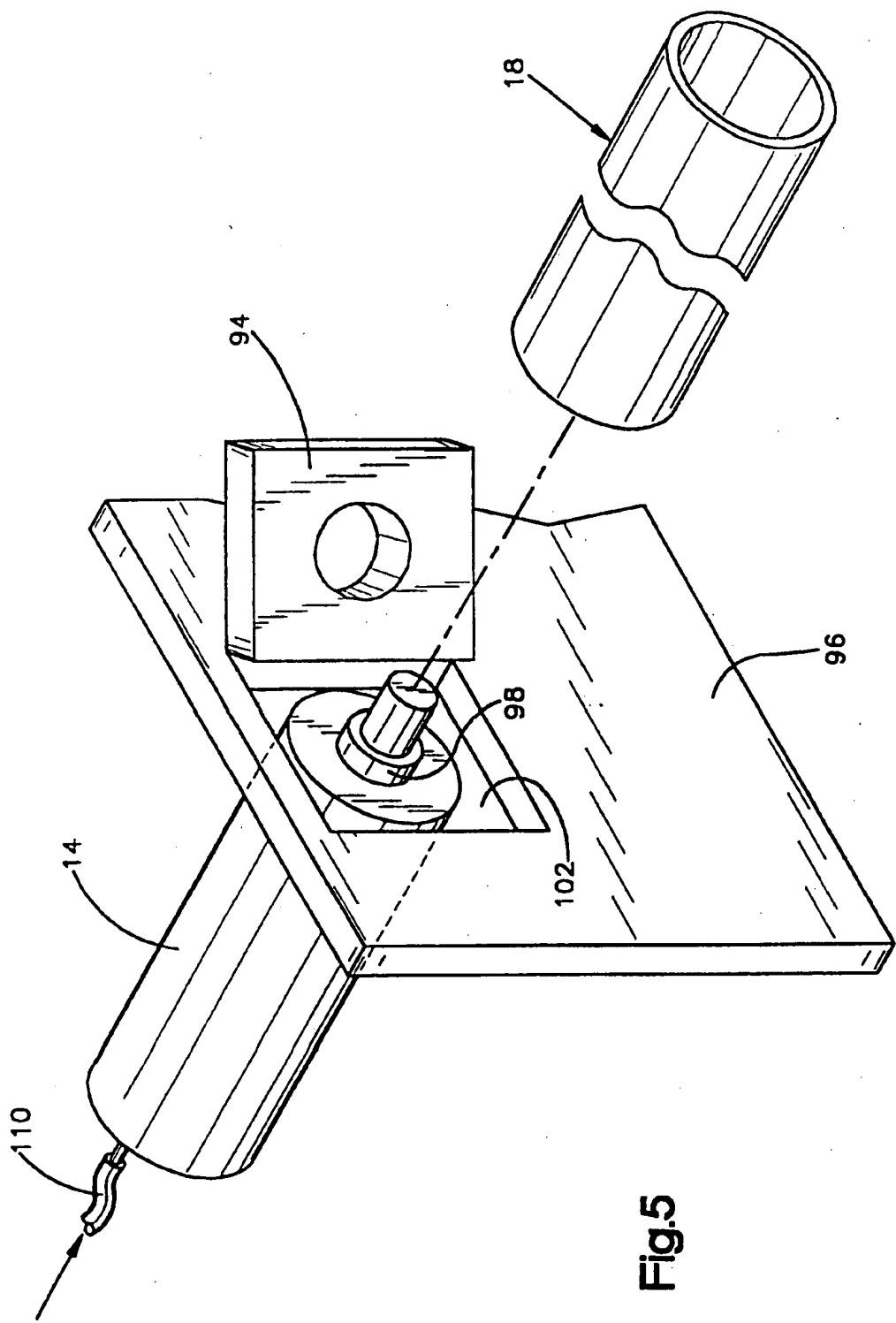


Fig.5

